

NAVSEA
STANDARD ITEM

FY-00

ITEM NO: 009-17
DATE: 06 NOV 1998
CATEGORY: II

1. SCOPE:

1.1 Title: Rotating Electrical Equipment; repair

2. REFERENCES:

- a. Standard Items
- b. Equipment Instruction Manual
- c. S9086-KC-STM-010/CH-300, Electric Plant - General
- d. S9086-KE-STM-000/CH-302, Electrical Motors and Controllers
- e. S9086-KN-STM-010/CH-310, Electrical Power Generators and Conversion Equipment
- f. S9086-HN-STM-010/CH-244, Propulsion Bearings and Seals
- g. 0900-LP-060-2010, Electrical Machinery Repair, Volume One, Electrical Motor Repair
- h. S9310-AC-HBK-010, Commutator/Slip Ring Maintenance Handbook
- i. MIL-STD-870, Cadmium Plating, Low Embrittlement, Electrodeposition
- j. MIL-STD-1310, Shipboard Bonding, Grounding, and Other Techniques for Electromagnetic Compatibility and Safety

3. REQUIREMENTS:

3.1 Accomplish preliminary repair preparations as follows:

3.1.1 Prior to disconnecting equipment:

3.1.1.1 Record and retain electrical hook-up data. Record |
and retain air gap readings and bearing clearances for sleeve bearing
equipment only.

3.1.1.2 Inspect couplings for cracks, broken segments, wear, and misalignment in excess of tolerances specified in 2.b.

3.1.1.3 Record motor shaft thrust and run out readings.

3.1.2 Disconnect electrically and mechanically the equipment, using 2.b for guidance.

3.1.3 Matchmark, identify, and retain chocks, shims, shock mounts, sound damping pads, and other accessories associated with equipment.

3.2 Remove equipment including rotating components connected directly to the shaft.

3.3 Inspect foundations for cracks, areas of distortion, and deterioration in excess of 25 percent of the thickness of each member of the structure.

3.3.1 Accomplish the requirements of 009-32 of 2.a for the foundations of the removed equipment.

3.4 Submit four legible copies of a report listing inspection results, missing parts, defective parts, and measurements taken in 3.1 and 3.3 to the SUPERVISOR.

3.5 Matchmark, disassemble, and inspect the equipment removed in 3.2, using 2.b through 2.g for guidance.

3.6 Accomplish 500 volt megger insulation resistance test, using Paragraphs 300-3.2.2 through 300-3.2.3, 300-3.4.8, 300-3.4.11, and 300-5.3.7.1 of 2.c for guidance. Record data.

3.6.1 Disconnect solid-state devices prior to measuring insulation resistance of windings.

3.7 Accomplish a DC resistance test of windings, using a Wheatstone or Kelvin bridge, or with an ohmmeter capable of resolving one milliohm (.001 ohm). Record phase balance for multi-phase equipment, using Paragraph 4-5.1 b. of 2.g for guidance. Record data.

3.8 Accomplish a voltage surge test in accordance with Paragraphs 300-3.5.4 through 300-3.5.5 of 2.c. Record data.

3.9 Accomplish a DC HI POT test in accordance with Paragraph 300-3.5.2 through 300-3.5.2.3.4 of 2.c. Record data.

3.10 Accomplish a Polarization Index Test in accordance with Paragraph 300-3.4.12 of 2.c. Record data.

3.11 Measure resistance value of each winding temperature detector, heaters, and heater strips using low voltage ohmmeter. Record data.

3.12 Submit four legible copies of a report listing the results of the requirements of 3.5 through 3.11 to the SUPERVISOR.

3.13 Clean the equipment and windings in accordance with Paragraphs 300-4.5.1 through 300-4.5.5 of 2.c.

3.13.1 Dry the equipment by placing it in an oven in accordance with Paragraph 300-5.3.2.3 of 2.c.

3.14 **Allow to** cool to ambient temperature and accomplish a 500-volt megger insulation resistance test, using Paragraphs 300-3.2.2 through 300-3.2.3, 300-3.4.8, 300-3.4.11, and 300-5.3.7.1 of 2.c for guidance. Record data.

3.15 Accomplish a DC HI POT test in accordance with Paragraphs 300-3.5.2.3 through 300-3.5.2.3.4 of 2.c. Record data.

3.16 Repeat cleaning, drying, and testing in 3.13 through 3.15 if DC HI POT test readings are questionable, or if insulation resistance readings are not in accordance with the following:

3.16.1 DC generators and motors (except propulsion and auxiliary generators for submarines) including exciters, Table 300-3-4 of 2.c.

3.16.2 DC propulsion generators and motors and DC auxiliary generators for submarines, Table 300-3-5 of 2.c.

3.16.3 AC generators and motors other than propulsion, Table 300-3-6 of 2.c.

3.16.4 AC propulsion generators and motors, Table 300-3-7 of 2.c.

3.17 If satisfactory readings are not obtained after the second cleaning, repeat 3.12 through 3.14.

3.18 Notify the SUPERVISOR if satisfactory readings are not obtained after a third cleaning.

3.19 Accomplish a DC resistance test of windings, using a Wheatstone or Kelvin bridge, or with an ohmmeter capable of resolving one milliohm (.001 ohm). Record phase balance for multi-phase equipment, using Paragraph 4-5.1 b. of 2.g for guidance. Record data.

3.20 Accomplish a voltage surge test in accordance with Paragraphs 300-3.5.4 through 300-3.5.5 of 2.c. Record data.

3.21 Submit four legible copies of a report listing windings containing defects such as opens, grounds, shorts, reversed or unbalanced coil groups or

phases, incorrect connections, cracked or brittle insulation, and loose bands, fillers, wedges, and connections to the SUPERVISOR.

3.21.1 Include test results from 3.14 *through 3.17*, 3.19 *and 3.20*.

3.22 Protect the windings and machined surfaces and clean the equipment housing including fan and interior and exterior of end bells to bare metal.

3.23 Inspect non-wound rotors for loose or cracked bars, localized overheating, and rubbing. Inspect wound rotors, slip ring leads, and armatures for insulation damage and burns/hot spots. Check for loose coils and slot wedges. Check slip rings and commutators for damage and for wear limits, using 2.b for criteria. Record data.

3.24 Inspect and dimensionally measure end bells, frame, shaft, sleeve and pedestal bearings, keyways, fan and running surfaces for wear, eccentricity, and other defects, using 2.b for accept or reject criteria, 2.f for location and type of measurements to be taken. Record data.

3.25 Inspect brush rigging for cracks, chips, worn areas, distortion, spring condition, and insulating material for cracks and arc paths. Record data.

3.26 Inspect leads and terminal lugs for damage and defects. Identify and tag leads with aluminum wrap-around bands with metal stamped or embossed markings. Record data.

3.27 Submit four legible copies of a report listing results of the requirements of 3.23 through 3.26 to the SUPERVISOR.

(V)(G) "VARNISH *TEMPERATURE, VISCOSITY, AND GEL TIME TESTS*"

3.28 Select the proper insulating process based on winding insulation classifications and to meet state or local air pollution standards.

3.28.1 Select varnish methods and material, using Paragraphs 300-4.5.8 through 300-4.5.8.2 of 2.c for guidance.

3.28.1.1 Maintain the varnish in accordance with Paragraphs 300-4.5.8.3 through 300-4.5.8.3.3 of 2.c and the varnish manufacturer's instructions.

3.28.1.2 Maintain a current revision of the varnish manufacturer's instructions on maintenance, storage, and use of the type of varnish to be applied.

3.28.1.3 Maintain a record of varnish temperature, viscosity and gel time tests. Tests must show varnish is within varnish manufacturer's recommendations and have been accomplished in the intervals specified by the

varnish manufacturer. The record must also show the varnish is being stored as recommended by the varnish manufacturer.

3.29 Insulate windings in accordance with Paragraphs 300-4.5.8.4 of 2.c and the varnish manufacturer's instructions.

3.29.1 Do not immerse the leads.

3.29.2 Wipe surfaces that affect assembly, such as rabbet fits and mounting flanges, with a cloth moistened with a solvent after draining and before baking.

3.30 Remove excess varnish runoff from the component locations described in 3.29.2, after baking. Apply a thin coat of air dry varnish to metal surfaces exposed by the removal process in accordance with Paragraph 300-4.5.8.5 and 300-4.5.8.6 of 2.c, after removing excess varnish runoff.

3.31 Repeat tests described in 3.14, 3.15, 3.19, and 3.20.

3.32 Accomplish an AC HI POT test in accordance with Paragraphs 300-3.5.3 through 300-3.5.3.2.9 of 2.c. Record data.

3.33 Accomplish a 500-volt megger insulation resistance test, using Paragraphs 300-3.2.2 through 300-3.2.3, 300-3.4.8, 300-3.4.11, and 300-5.3.7.1 of 2.c for guidance. Record data.

3.34 Submit four legible copies of a report listing the results of the requirements of 3.31 through 3.33 to the SUPERVISOR.

3.35 True the commutator or collector rings. Eccentricity shall not exceed 0.002 inch total indicator reading (TIR). Resurface or machine each individual collector ring to the same exact diameter to allow symmetrical brush holder to ring clearance spacing. Ensure metal shavings are not permitted to contaminate the rotor or stator assembly.

3.35.1 Each cut shall not exceed 0.010 inch. Finish thickness shall not be less than design wear tolerance as shown in 2.b.

3.35.2 Undercut the mica between the commutator bars with the edge of the mica not exceeding a depth of 5/64-inch below the bars.

3.35.3 Chamfer the bar edges and remove rough surfaces in accordance with Paragraph 5-2-4 of 2.h.

3.35.4 Burnish the commutator with a very fine commercial burnishing stone conforming to MIL-S-17346. Polish collector rings to a mirror finish.

3.36 Accomplish the requirements of 009-15 of 2.a for each rotating assembly.

3.37 Accomplish the following for the brush rigging:

3.37.1 Disassemble the brush rigging.

3.37.2 Remove foreign matter.

3.37.3 Replate cadmium plated items in accordance with 2.i. Replate zinc-plated items in accordance with ASTM Standard A153. ***In localities with environmental or air pollution restrictions against cadmium plating, use zinc plating for all plated steel parts.***

3.37.4 Recondition threads of plated parts.

3.37.5 Assemble brush rigging.

3.38 Install identification markers on wiring in the external connection box. Step keys shall not be used.

3.38.1 Markers shall be aluminum wrap-around type with metal-stamped or embossed markings.

3.39 Repair lightly scored areas of frame, end bells, and shaft by manual methods. Recondition threads and fit key to keyway.

3.39.1 Apply a thin coat of petrolatum to unpainted mating surfaces except for explosion-proof motors which shall have clean, dry mating surfaces.

3.40 Prepare and refinish equipment. Protect machine surfaces, windings, and nameplates from being painted or otherwise damaged.

3.40.1 Accomplish the requirements of 009-32 of 2.a for each housing, fan, and interior and exterior of each end bell.

3.41 Accomplish the following on equipment having other than sleeve-type bearings unless otherwise specified in the invoking Work Item, using 2.g for guidance.

3.41.1 Install new bearings, seals, fittings, lock washers, and locknuts conforming to 2.b, using 2.f and Chapter 7 of 2.g for guidance.

3.41.1.1 Install new Type **111**, Class 8 (sealed) bearings in vaneaxial and tubeaxial fan motors originally furnished with Type **111** bearings. Install Type 120 bearings in vaneaxial and tubeaxial fan motors originally furnished with Type 120 bearings.

3.41.2 Lubricate bearings with grease conforming to DOD-G-24508 as required in Paragraphs 244-1.7.7.1 and 244-1.7.7.3 of 2.f.

3.41.2.1 Install new label plates with the inscription "DO NOT LUBRICATE" on equipment with sealed bearings (Type **111**, Class 8 or Type 120).

3.42 Assemble the equipment disassembled in 3.5, using 2.b through 2.g for guidance.

3.42.1 Do not **use** materials containing silicone in the repair and reassembly **of equipment** with commutator or collector rings.

3.42.2 Install new fasteners conforming to MIL-S-1222, Type I or II, Grade 5, zinc coated.

3.42.3 Fasteners requiring a permeability factor of 2.0 or less shall conform to Grade 304 CRES.

3.42.4 Install new gaskets on covers, inspection plates, and between the external connection box and the frame. Gaskets shall conform to MIL-G-1149 unless otherwise specified in 2.b.

3.42.5 Set brush holders not less than 1/16-inch or more than 1/8-inch from commutator or collector rings unless otherwise specified in 2.b.

3.42.6 Set brush holders in neutral position of pole pieces and stagger brushes for maximum coverage of the commutator, in accordance with Paragraph 300-4.7.7.1.10 of 2.c.

3.42.7 Center the brush holder over the collector rings.

3.42.7.1 Ensure the brushes do not extend beyond the edge of the collector rings.

3.42.8 Install new brushes in accordance with 2.b. Sand new brushes to fit curvature of the commutator or collector rings, using Paragraph 4-4-4.2 through 4-4-4.4 of 2.h for guidance.

3.42.8.1 Brushes shall have a surface contact of 100 percent and shall not be chipped or broken on either heel or toe.

3.42.8.2 Remove sand, carbon, and other foreign matter resulting from fitting new brushes.

3.42.9 Adjust spring tension of brushes in accordance with 2.b.

3.42.10 Adjust air gap to within tolerances specified in 2.b.

3.42.11 **Rotate** shaft **by hand a minimum of** three revolutions. Binding or rubbing allowed: None.

3.42.12 Measure resistance value of each winding temperature detector, using a low voltage ohmmeter. Record data.

3.42.12.1 Submit four legible copies of a report of readings to the SUPERVISOR, within 48 hours after completion of tests.

3.42.13 Install label plates conforming to MIL-P-15024 for those found to be missing or damaged.

(V)(G) "NO-LOAD SHOP TEST"

3.43 Accomplish a no-load shop test of the motor for a minimum of one-half hour.

3.43.1 After one-half hour, record current and voltage in each phase, speed and bearing temperature rise measured on the equipment's exterior near each bearing.

3.43.2 Submit four legible copies of the recorded data to the SUPERVISOR.

3.44 Install equipment removed in 3.2.

3.44.1 Remove existing and install new foundation fasteners conforming to MIL-S-1222, Type I or II, Grade 5, zinc coated, and self-locking hexagon nuts conforming to MIL-N-25027, excluding body-fitted bolts and studs.

3.44.2 Remove existing galled or distorted body-fitted bolts and studs and install new fitted bolts and studs conforming to MIL-S-1222, Type I, Grade 5.

3.44.3 Fasteners, body-fitting bolts, and studs requiring a permeability factor of 2.0 or less shall conform to Grade 304 CRES.

3.44.4 Align equipment in accordance with 2.b.

3.44.4.1 Accomplish the requirements of 009-58 of 2.a for driver and pump shafts.

3.44.5 Install chocks, shims, ground straps, shock mounts, and sound damping pads. Measure and record facial and peripheral coupling data.

3.44.5.1 Bond and ground equipment in accordance with 2.j, using new ground straps.

3.44.6 Connect electrical cables to equipment, using data retained in 3.1.1.1.

3.44.7 **Rotate** shaft **by hand a minimum of** three revolutions. |
Binding or rubbing allowed: None.

3.44.8 Measure and record the air gap and bearing clearance (sleeve bearing equipment only), insulation resistance (at 500 volts DC), and thrust.

(V)(G) "OPERATIONAL TEST"

3.45 Accomplish an operational test of the equipment at full nameplate load or maximum system capacity for a minimum of one hour after temperatures stabilize, unless otherwise specified in the invoking Work Item.

3.45.1 Verify oxide film coating of the commutator/collector rings in accordance with 2.h.

3.45.2 Record current, voltage, frame and bearing temperature rise, and speed at 15 minute intervals.

3.45.3 Bearing temperatures shall not exceed 180 degrees Fahrenheit unless otherwise specified in the invoking work item or equipment instruction manual.

3.45.4 Measure and record hot insulation resistances of windings to ground immediately upon completion of test, using a 500 volt megger.

3.46 Submit four legible copies of a report listing data recorded in 3.44.5, 3.44.8, 3.45.2, and 3.45.4 to the SUPERVISOR.

4. NOTES:

4.1 Equipment instruction manual and drawings will be referenced in the invoking Work Item.

4.2 Shop test of generator will be addressed in the invoking Work Item.

4.3 The use of silicone is not allowed on any rotating electrical machinery.